PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Closure Elements for Plates of Fluid Exchange Columns and Such Plates and Columns

We, SOCIETE POUR L'EQUIPMENT DES INDUSTRIES CHIMIQUES S.P.E.I.CHIM. — Reunion des Anciens Etablissements Barbet, Egrot & Grance, Pingris & Mollet-Fontaine, Societe Anonyme, a French Body Corporate of 106 Rue Amsterdam, Paris, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to closure elements for plates of fluid exchange columns, and to such plates and columns.

As is known, in columns for exchange between liquid or gaseous fluids or between two immiscible liquids of different density forming different phases, for example distillation, absorption, scrubbing and extraction columns, the plates are apertured to enable gas or vapour to flow upwards through the colunms. The plates may be of the bubble cap type or of the valve tray type. In the former type a bubble cap, the peripheral edge of which may be notched or indented, is mounted over the top of a tubular element commonly known as a "riser" so that the ascending gas, vapour or liquid after passing up through the riser is deflected downwards and then bubbles through the liquid which collects on the plate. In plates of the valve tray type, the apertures are, however, substantially coplanar with the plate and are provided with a closure element, usually of flat or domed form, a guiding device being arranged to ensure that said element is vertically moveable and serves to mask and unmask the apertures in the plate. These closure elements for plates of the valve tray type, whether solid or perforated, rest on their seat by gravity and are raised by the rising flow of gas or vapour or of the lighter liquid when the differential pressure exceeds a certain value.

It has already been proposed to provide such flat or dome-shaped closure elements for plates of the valve tray type with a number of projections distributed around the periphery with the object of preventing the element from sticking in the stationary position.

An object of the present invention is to provide an improved closure element for a plate of the valve tray type.

In accordance with the invention, there is provided a closure element for partly closing an aperture in a plate of the valve tray type for a fluid exchange column comprising a cap adapted to rest on the portion of the plate surrounding an aperture, such cap having an undulating lower surface around its periphery to provide a plurality of channels for flow of gas, vapour or liquid through the apertures and past the edge of the cap.

The cap-like element thus designed may be combined with a device for guiding its upward and downward movement, more-especially with means for limiting the said upward movement. The said device may be formed separate from and subsequently fixed to the cap or may be formed integrally therewith.

In order that the invention may more readily be understood the following description is given, by way of example with reference to the accompanying drawings, in which:—

FIGURES 1 to 5 are half-sections of caps constructed in accordance with the invention and illustrated in the partly closed position on their cooperating plates;

FIGURE 6 is an elevational view, half of which shows a cap according to the invention together with its guide device, and

[Price 4s. 6d.]

half the guide device alone;

FIGURE 7 is a view of the blank from which the guide device is produced;

FIGURE 8 is a view similar to Figure 7 showing a variant;

FIGURE 9 is an elevational view of a cap provided with guide lugs, the co-operating plate being shown in section;

FIGURE 10 is an underneath plan of the cap and plate of Figure 9.

FIGURE 11 is a view similar to Figure 10, showing a variant;

FIGURE 12 shows in plan view a blank for a simple guide device before the bending of the lugs;

FIGURE 13 shows in elevation the cap provided with the guide device formed from the blank of Figure 12;

FIGURE 14 is an underneath plan view of the cap of Figure 13 and the co-operating plate from below;

FIGURE 15 is a view similar to Figure 7, of a modification of a blank;

FIGURE 16 is a plan view of the plate which is to co-operate with a cap, fitted with the guide device formed from the blank of Figure 15;

FIGURE 17 is an underneath plan view of the plate of Figure 16 with the cap fitted;

FIGURE 18 is a transverse section through the cap alone of Figure 17;

FIGURE 19 is a view similar to Figure 18, showing a variant;

FIGURE 20 is an elevational view of another form of cap;

FIGURE 21 is a plan view, partly broken away, of the cap of Figure 20 in position on the co-operating plate;

FIGURE 22 is a view of a cut-out blank employed for the production of another cap;

FIGURE 23 is a corresponding plan view of the cap formed from the blank of Figure 22 in position on the co-operating plate;

FIGURES 24 and 25 are transverse sections of Figure 23 parallel and perpendicular to the plane of the lugs;

FIGURES 26 to 28, which are similar to Figures 22 to 24, relate to a first variant;

FIGURES 29 to 32, which are similar to Figures 22 to 25, relate to a second variant, and,

FIGURE 33, which is similar to Figure 31, concerns a third variant.

In accordance with Figure 1, the cap intended partly to close the aperture 1 in a column plate 2 consists of a disc 3, which has been so pressed around its periphery as to comprise a series of undulations, of which the depressed portions 4*a* rest on the plate 1 around the aperture 2, with the intermediate crests 4*b* therebetween. In order to provide channels of larger cross-sectional areas for throughflow of vapour between the undulations, the crests may be coplanar with the remainder of the upper face of the disc 3 (crests 4*c* of Figure 2) or may even rise above the remainder (crests 4*d* of Figure 3).

Instead of the flat disc shown in Figures 1 to 3, the cap may comprise a disc 3*a* curved in dome form as illustrated in Figure 4 or a disc 3*b* formed with a central dished portion (Figure 5). In the latter case, the dished portion may receive a securing member of a guide device which does not project beyond the upper portion of the disc.

The guide and travel-limiting devices illustrated in Figure 6 in combination with a cap 3, 4*a*, 4*b* is formed from the sheet-metal blank 5 illustrated in Figure 7. The said blank 5 is of square form in the example chosen and is recessed in such manner as to define four diagonal lugs 9 extending radially from a central portion 8, and between them eight shorter teeth 10. The member thus recessed is bent over, around the periphery of the portion 8, so as to form (Figure 6) a base which can be fixed in the cap and also, below the base, a recessed cylindrical skirt, the ends of the lugs 9 being bent back on themselves to form claws 9*a*. These abutments project sufficiently from the cylindrical skirt, to make it necessary for the member to be forced into an aperture in a co-operating plate, whereafter the claws return resiliently to their initial position, to form abutments limiting the upward travel of the closure member, while the teeth 10 of the remainder of the skirt ensure that the closure member is guided in its movements.

The base of the travel-guiding and limiting device may be fixed below the cap in any appropriate way, for example by welding.

As is shown in Figure 8, the travel-guiding and limiting device, while still being of the same type, may be manufactured from a blank of different shape, for example a hexagonal blank 11 having three lugs 12 and three groups of three shorter teeth 13. The number and shape of the teeth 10 and 13 and of the lugs 9 and 12 may be chosen as desired.

A cap 14 (Figures 9 and 10) having peripheral undulations may also be produced, in the same way as the guiding and travel-limiting device, from a blank having lugs 15 at intervals between the undulating disc portions. In order that these lugs should guide the cap better than if they were simply engaged in the aperture 16 of the plate 17, a slot 18 or, preferably, a notch 18*a* in the aperture 16 (Figure 10) may be provided in the plate 17 for the passage of each one of them. With this arrangement, the number of lugs may be reduced to two. In the example illustrated in the drawings, each lug 15 has near its end, a transverse

slot which enables a portion of the metal to be laterally bent over in order to form an abutment 15*a* after the positioning. The travel limiting may also be ensured by bending over the lugs 15 upwardly as at 9*a* in Figure 6 or horizontally as at 30*a* in Figure 18.

In all the foregoing examples, the aperture in the plate and the corresponding closure member need not be of circular form. Figure 11 illustrates by way of example a plate aperture 19 and a cap 20, both of which are triangular.

Likewise, it is unnecessary for the cap and the base of the travel-guiding and limiting device hereinbefore described to have corresponding shapes. Figure 12 illustrates by way of example a device having a triangular dome 21 with three lugs 22 which device may be secured under a round cap 23 having peripheral undulations (Figure 13), while Figure 14 illustrates the same triangular base 24 in combination with a cap 25 also of triangular form, which is disposed above the aperture 26 in the plate.

Instead of being cut out from the initial blank so as to extend in radial directions, the lugs may be cut out so as to extend tangentially. Figure 15 illustrates such a blank comprising a disc 27 which is integrally formed, along diametral bending lines 28, 29 with tangential lugs 30, 31 separated from the said disc by cuts 32, 33. After having been bent over at a right angle, the lugs are intended to be engaged in diametral guide slots 34, 35 extending from the edge of the aperture 36 in the plate 37 (Figure 16) and the periphery of the disc is bent over to form undulations 38 intended to rest on the plate 37 around the aperture 36. After positioning, the ends 30*a*, 31*a* of the lugs may be bent over at a right angle to form retaining claws (Figure 18). In a modified form, each lug may be transversely slotted close to its end and a portion of the metal bent over as indicated at 30*b* in Figure 19, in the manner hereinbefore described.

The cap illustrated in Figures 20 and 21 is produced, as those of Figures 15 to 19, from a metal blank which is cut out and then bent. Three lugs 40 are integral with the disc 41, which is undulating around its periphery, and the corresponding bending lines are slightly offset from radial. The cut 45 separating each lug from the disc is extended into the latter somewhat beyond the bending line. Each lug has in its lower portion a retaining tooth 40*a* externally bounded by an inclined surface 40*b*. The slots 42 extending around the aperture 44 in the plate 43 to receive the lugs 40 are also offset. With this arrangement, the cap is more stable in the uppermost position. In addition, it is possible to position it from above by introducing the lugs 40 into the slots 42, the lugs being resiliently retracted by the ends of the slots 45 until the inclined surfaces 40*b* have cleared the plate, whereafter they return to their normal position, in which the teeth 40*a* form abutments limiting the upward travel. The direction of each lug differs slightly from a radial direction, and the loss of pressure caused by their presence is negligible. This constructional form is advantageous by reason of the small extent of the recesses left by the lugs in the peripheral undulations after the downward bending.

In the case of Figures 22 to 25, the cap and the lugs are obtained from a square blank 54 comprising two projecting portions along each of two of its opposite sides 46. Each of the projecting portions is bounded by an inclined surface 47 on the side remote from the twin projecting portion. Cuts 48, 49, 50 separate, from the square portion, a lug 51 externally terminated by a retaining tooth 52. Each of the lugs thus defined is bent through a right angle about the bending line 53, the cut 50 being sufficiently long to extend beyond the line 53 towards the interior. The blank 54 is made to have an undulating periphery as described in the foregoing.

The cap thus formed is positioned as before from above in the square aperture 55 in a plate 56.

It will be noted that the shape of the blank makes it possible to reduce the metal waste during its cutting.

A square cap of similar shape is illustrated in Figures 26 to 28. In this case, the lugs 57 are straight and their end is bent over to form a hook or claw 58. Here again, the positioning is effected from above the plate 59 through the aperture 60 by means of the resilience of the lugs 57.

In accordance with the modification of Figures 29 to 32, combs 61 are provided instead of separate lugs each tooth 62 of the comb being bent over at its end to form a hook or claw 63, the positioning being effected from above the plate 64 through the aperture 65 by means of the resilience of the combs 61. The combs improve the dispersion of the vapour and increase the efficiency.

This modification is particularly desirable for small caps associated with square or rectangular apertures measuring, for example, 15 mm. along their shorter side. The number of teeth in the comb may then be reduced to two. A single lug 66 may even be provided terminated by a claw 67 (Figure 33) along two opposite sides of a square blank, the passage of vapour along the shorter sides of the rectangle being sacrificed.

In the constructional forms of Figures

22 to 33, it is preferable for the corners of the blank, such as 68 in Figure 30, to correspond to low points of the undulations and the ends 69 of the edges of the slots to the crests to facilitate the passage of vapour from behind the lugs or teeth.

The constructional forms of Figures 22 to 33 may be applicable either to square or to rectangular blanks and apertures.

WHAT WE CLAIM IS:—

1. A closure element for partly closing an aperture in a plate of the valve tray type for a fluid exchange column comprising a cap adapted to rest on the portion of the plate surrounding an aperture, such cap having an undulating surface around its periphery to provide a plurality of channels for flow of gas, vapour or liquid through the aperture and past the edge of the cap.

2. An element according to claim 1 and including a device on said element for guiding the cap so that when this raised by flow of gas, vapour or liquid it moves in a vertical direction.

3. An element according to claim 2, wherein said device comprises a base fixed to said cap, said base having extending therefrom at least one lug slidingly cooperating with a hole in said plate thereby to guide said cap.

4. An element according to claim 3, wherein the said hole is separate from said aperture partly closed by said cap.

5. An element according to claim 3, wherein said aperture forms said hole in said plate.

6. An element according to any of the claims 2 to 5, wherein means are associated with said device for limiting upward movement of said cap.

7. An element according to claims 3 and 6, wherein said means comprises an abutment on the end of said lug or lugs.

8. A closure element constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

9. Plates of the sieve type for a fluid exchange column formed with apertures such apertures being fitted with elements according to any preceding claim.

10. A fluid exchange column having plates according to claim 9.

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SHEET 1

Fig.1

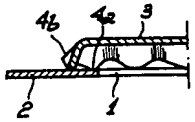

Fig.2

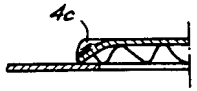

Fig.3

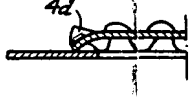

Fig.4

Fig.5

Fig.6

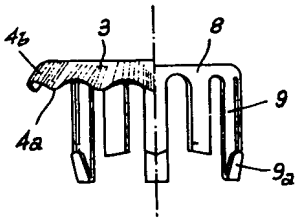

Fig.7

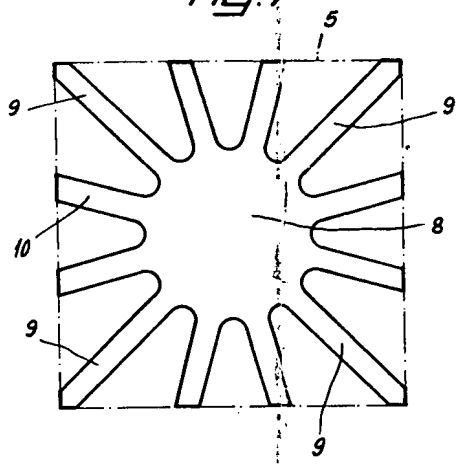

Fig.8

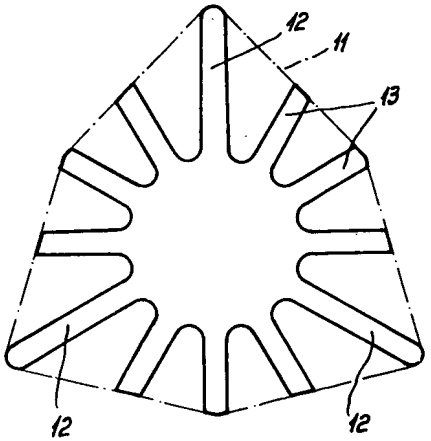

Fig.9

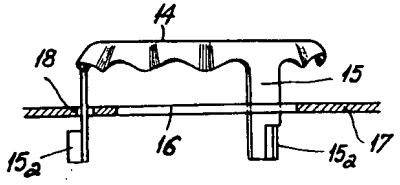

Fig.10

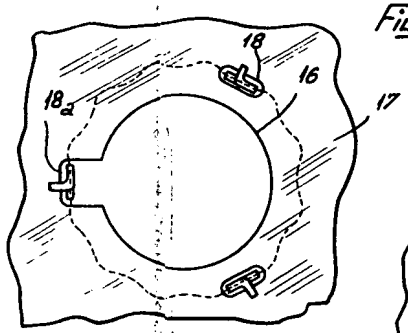

Fig.11

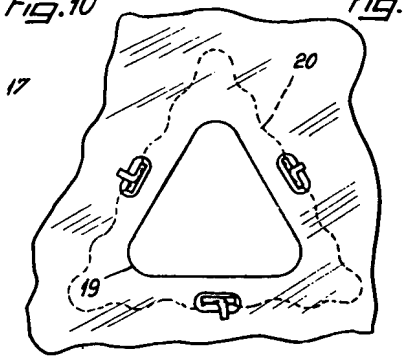

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Fig. 12

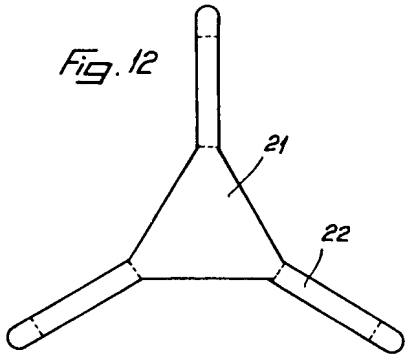

Fig. 13

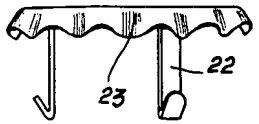

Fig. 14

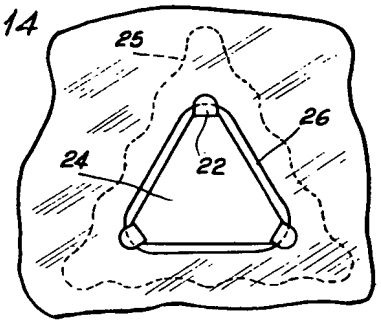

Fig. 20

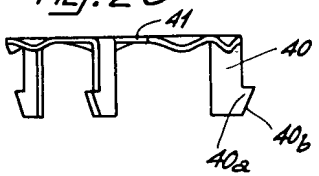

Fig. 21

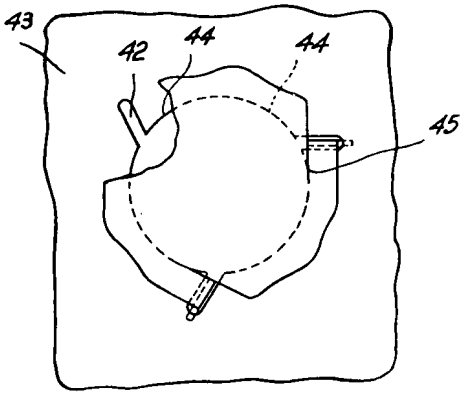

Fig. 22

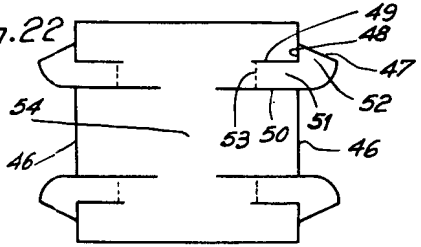

Fig. 23

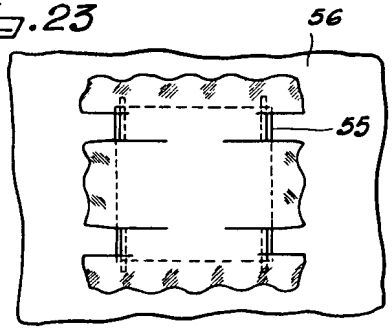

Fig. 24

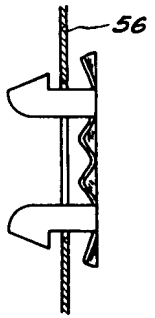

Fig. 25

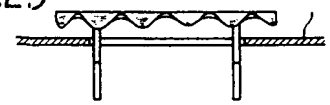

Fig. 15

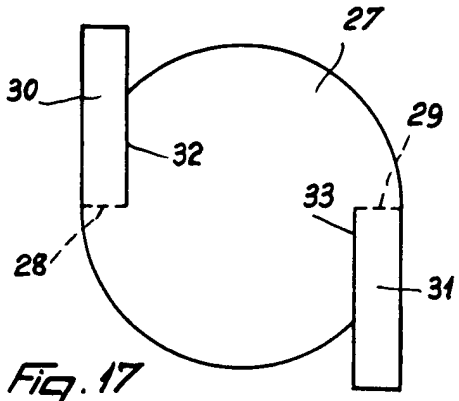

Fig. 16

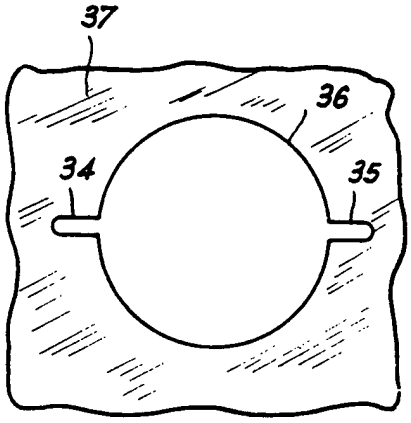

Fig. 17

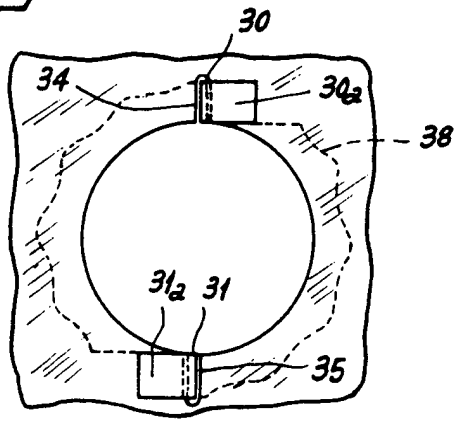

Fig. 18

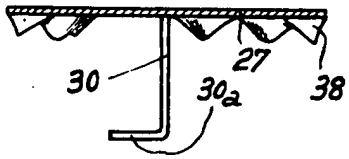

Fig. 19

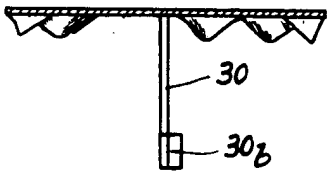

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Fig. 26

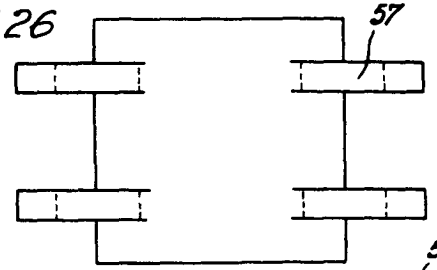

Fig. 27

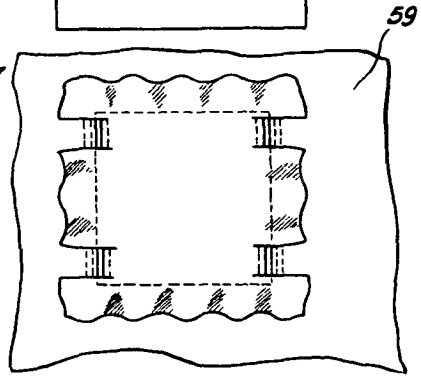

Fig. 28

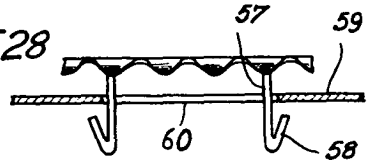

Fig. 29

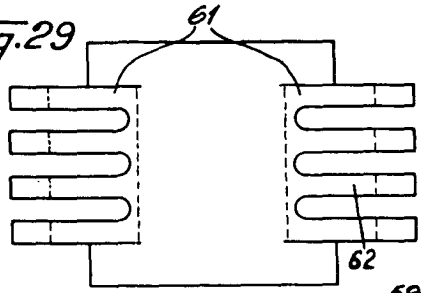

Fig. 30

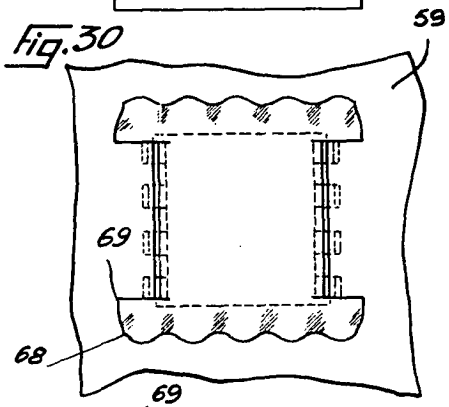

Fig. 32

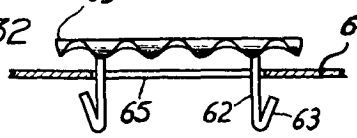

Fig. 33

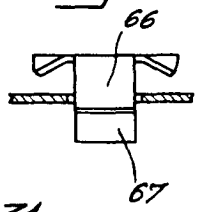

Fig. 31